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Characterization of heavy metal uptake and tolerance in plants has become more widely studied to develop applications that use plants to clean up toxic heavy metal soil contamination. This technology, phytoremediation, has especially been applied to lead (Pb) contamination. Since lead is not a plant nutrient, genetic engineering of plants to enhance Pb uptake, sequestration and translocation is needed. To study possible mechanisms for lead tolerance in plants, EMS-mutagenized seeds of *Arabidopsis thaliana* were screened on a lead medium optimized for selection of lead tolerance. One mutant line showed tolerance to Pb after germinating the M_3 generation on medium containing 0.2 g/L Pb. Comparison of mutants to wild type on higher concentrations of Pb demonstrated mutant tolerance to Pb. Measurement of the intracellular content of lead in plant tissues using ICP-AES will determine whether the mechanism of mutant Pb tolerance is due to avoidance of Pb or due to intracellular Pb sequestration. Additionally, plants will be genetically engineered to over-express the gene encoding for glutathione synthetase (*gshII*), an enzyme involved in the synthesis of phytochelatins (PCs). Intracellular chelation of heavy metals with PCs and subsequent complex sequestration into vacuoles is the mechanism by which plants detoxify these metals. Over-production of PCs is expected to enhance lead tolerance. The *gshII* gene was subcloned into the pCM35S plant binary expression vector and will be used to transform wild type *Arabidopsis thaliana*. Transformants will then be selected and tested for Pb tolerance on Pb-supplemented medium. The amounts of Pb taken up by the transformants versus the wild type will be assessed using ICP-AES.